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EMC Technologies Pty Ltd

ABN 82 057 105 549
176 Harrick Road
Keilor Park
Victoria Australia 3042

Ph: + 613 9365 1000
Fax: + 613 9331 7455
email: melb@emctech.com.au

SAR Test Report

Report Number: M140907

Evaluation of the SAR of Samsung Galaxy and Apple iPhones When Fitted With the Brainwave Smart Chip

Date of Issue: 24th September 2014

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8.0 SAR EVALUATION RESULTS

The SAR values averaged over 10 g tissue masses were determined for the sample device for the Left and Right ear configurations of the phantom. The results for 850 MHz, 900 MHz, 1900 MHz and 1950 MHz UMTS bands are given in the tables below.

The plots with the corresponding SAR distributions are contained in Appendix B of this report.

8.1 SAR Measurement Results for iPhone 5

Table: SAR Measurement Results – UMTS 850MHz

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (10g) mW/g	Drift (dB)	ϵ_r (target 41.5 \pm 5% 39.4 to 43.6)	σ (target 0.90 \pm 5% 0.86 to 0.95)
Touch Left with Chip	1	WCDMA - UMTS	4183	836.6	0.028	-0.13	40.49	0.8791
Touch Right with Chip	2	WCDMA - UMTS	4183	836.6	0.027	-0.14	40.49	0.8791
Touch Left without Chip	3	WCDMA - UMTS	4183	836.6	0.470	-0.13	40.49	0.8791
Touch Right without Chip	4	WCDMA - UMTS	4183	836.6	0.431	-0.02	40.49	0.8791
System Check	5	CW	1	900	1.7	0	39.72	0.9397

Note: The uncertainty of the system ($\pm 23.1\%$) has not been added to the result.

Table: SAR Measurement Results – UMTS 1900MHz

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (10g) mW/g	Drift (dB)	ϵ_r (target 40.0 \pm 5% 38.0 to 42.0)	σ (target 1.40 \pm 5% 1.33 to 1.47)
Touch Right with Chip	6	WCDMA - UMTS	9400	1880	0.403	-0.18	40.81	1.368
Touch Left with Chip	7	WCDMA - UMTS	9400	1880	0.250	-0.02	40.81	1.368
Touch Right without Chip	8	WCDMA - UMTS	9400	1880	0.763	-0.17	40.81	1.368
Touch Left without Chip	9	WCDMA - UMTS	9400	1880	0.420	-0.06	40.81	1.368
System Check	10	CW	1	1950	5.25	0.05	40.67	1.416

Note: The uncertainty of the system ($\pm 23.1\%$) has not been added to the result.

8.2 SAR Measurement Results for iPhone 5S

Table: SAR Measurement Results – UMTS 900MHz

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (10g) mW/g	Drift (dB)	ϵ_r (target 41.5 \pm 5% 39.4 to 43.6)	σ (target 0.97 \pm 5% 0.92 to 1.02)
Touch Left with Chip	11	WCDMA - UMTS	2788	897.6	0.035	-0.2	39.74	0.9377
Touch Right with Chip	12	WCDMA - UMTS	2788	897.6	0.022	0.02	39.74	0.9377
Touch Left without Chip	13	WCDMA - UMTS	2788	897.6	0.495	-0.15	39.74	0.9377
Touch Right without Chip	14	WCDMA - UMTS	2788	897.6	0.448	0.2	39.74	0.9377

Note: The uncertainty of the system ($\pm 23.1\%$) has not been added to the result.



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Table: SAR Measurement Results – UMTS 2100MHz

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (10g) mW/g	Drift (dB)	ϵ_r (target 40.0 \pm 5% 38.0 to 42.0)	σ (target 1.40 \pm 5% 1.33 to 1.47)
Touch Left with Chip	15	WCDMA - UMTS	9750	1950	0.046	0.11	40.67	1.416
Touch Right with Chip	16	WCDMA - UMTS	9750	1950	0.122	-0.19	40.67	1.416
Touch Left without Chip	17	WCDMA - UMTS	9750	1950	0.472	0.12	40.67	1.416
Touch Right without Chip	18	WCDMA - UMTS	9750	1950	0.775	0.07	40.67	1.416

Note: The uncertainty of the system ($\pm 23.1\%$) has not been added to the result.

8.3 SAR Measurement Results for Samsung Galaxy S4

Table: SAR Measurement Results – UMTS 1900MHz

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (10g) mW/g	Drift (dB)	ϵ_r (target 40.0 \pm 5% 38.0 to 42.0)	σ (target 1.40 \pm 5% 1.33 to 1.47)
Touch Left with Chip	19	WCDMA - UMTS	9400	1880	0.031	-0.13	40.81	1.368
Touch Right with Chip	20	WCDMA - UMTS	9400	1880	0.019	0.18	40.81	1.368
Touch Left without Chip	21	WCDMA - UMTS	9400	1880	0.306	-0.1	40.81	1.368
Touch Right without Chip	22	WCDMA - UMTS	9400	1880	0.176	0.09	40.81	1.368

Note: The uncertainty of the system ($\pm 23.1\%$) has not been added to the result.

Table: SAR Measurement Results – UMTS 2100MHz

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (10g) mW/g	Drift (dB)	ϵ_r (target 40.0 \pm 5% 38.0 to 42.0)	σ (target 1.40 \pm 5% 1.33 to 1.47)
Touch Left with Chip	23	WCDMA - UMTS	9750	1950	0.025	-0.04	40.67	1.416
Touch Right with Chip	24	WCDMA - UMTS	9750	1950	0.011	0.07	40.67	1.416
Touch Left without Chip	25	WCDMA - UMTS	9750	1950	0.322	0.15	40.67	1.416
Touch Right without Chip	26	WCDMA - UMTS	9750	1950	0.162	-0.05	40.67	1.416

Note: The uncertainty of the system ($\pm 23.1\%$) has not been added to the result.

8.4 SAR Measurement Results for Samsung Galaxy S5

Table: SAR Measurement Results – UMTS 900MHz

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (10g) mW/g	Drift (dB)	ϵ_r (target 41.5 \pm 5% 39.4 to 43.6)	σ (target 0.97 \pm 5% 0.92 to 1.02)
Touch Left with chip	27	WCDMA - UMTS	2788	897.6	0.219	-0.01	41.5	0.97
Touch Right with chip	28	WCDMA - UMTS	2788	897.6	0.188	-0.05	41.5	0.97
Touch Left without chip	29	WCDMA - UMTS	2788	897.6	0.411	0.06	41.5	0.97
Touch Right without chip	30	WCDMA - UMTS	2788	897.6	0.321	0.02	41.5	0.97

Note: The uncertainty of the system ($\pm 23.1\%$) has not been added to the result.

Table: SAR Measurement Results – UMTS 2100MHz

Test Position	Plot No.	Test Mode	Test Ch.	Test Freq. (MHz)	SAR (10g) mW/g	Drift (dB)	ϵ_r (target 40.0 \pm 5% 38.0 to 42.0)	σ (target 1.40 \pm 5% 1.33 to 1.47)
Touch Left with chip	31	WCDMA - UMTS	9750	1950	0.068	0.15	40.67	1.416
Touch Right with chip	32	WCDMA - UMTS	9750	1950	0.040	0.18	40.67	1.416
Touch Left without chip	33	WCDMA - UMTS	9750	1950	0.264	-0.04	40.67	1.416
Touch Right without chip	34	WCDMA - UMTS	9750	1950	0.143	0.04	40.67	1.416

Note: The uncertainty of the system ($\pm 23.1\%$) has not been added to the result.



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9.0 CONCLUSION

Device	Band	Test Position	Test Ch.	Test Freq. (MHz)	SAR with chip (10g) mW/g	SAR without chip (10g) mW/g	Δ SAR	Δ SAR Percentage (%)
iPhone 5	UMTS-850MHz	Touch Left	4183	836.6	0.028	0.470	0.442	94.0
		Touch Right	4183	836.6	0.027	0.431	0.404	93.7
	UMTS-1900MHz	Touch Left	9400	1880	0.250	0.420	0.17	40.5
		Touch Right	9400	1880	0.403	0.763	0.36	47.2
iPhone 5S	UMTS-900MHz	Touch Left	2788	897.6	0.035	0.495	0.46	92.9
		Touch Right	2788	897.6	0.022	0.448	0.426	95.1
	UMTS-2100MHz	Touch Left	9750	1950	0.046	0.472	0.426	90.3
		Touch Right	9750	1950	0.122	0.775	0.653	84.3
Samsung Galaxy S4	UMTS-1900MHz	Touch Left	9400	1880	0.031	0.306	0.275	89.9
		Touch Right	9400	1880	0.019	0.176	0.157	89.2
	UMTS-2100MHz	Touch Left	9750	1950	0.025	0.322	0.297	92.2
		Touch Right	9750	1950	0.011	0.162	0.151	93.2
Samsung Galaxy S5	UMTS-900MHz	Touch Left	2788	897.6	0.219	0.411	0.192	46.7
		Touch Right	2788	897.6	0.188	0.321	0.133	41.4
	UMTS-2100MHz	Touch Left	9750	1950	0.068	0.264	0.196	74.2
		Touch Right	9750	1950	0.040	0.143	0.103	72.0

The Brainwave Smart Chip was tested in Samsung Galaxy S4/S5 and Apple iPhone 5/5s for the Touch position at the Head, Left and Right Ear in the centre frequency of each of the bands tested.

The Smart Chip resulted in a SAR reduction ranging from 40.5% to 95.1%. The Network Performance of each phone was not checked.



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